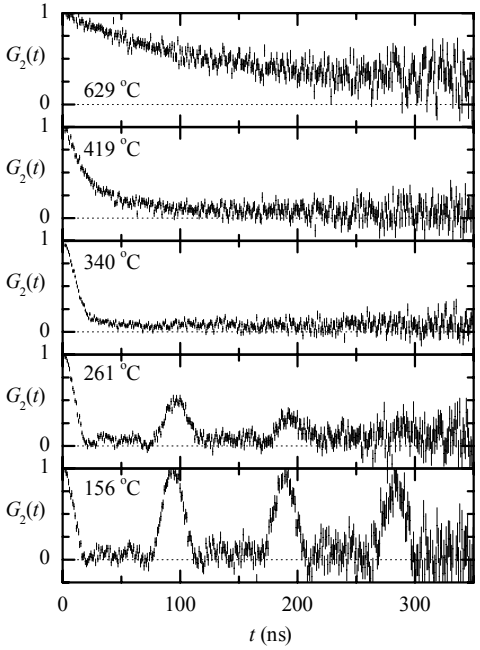
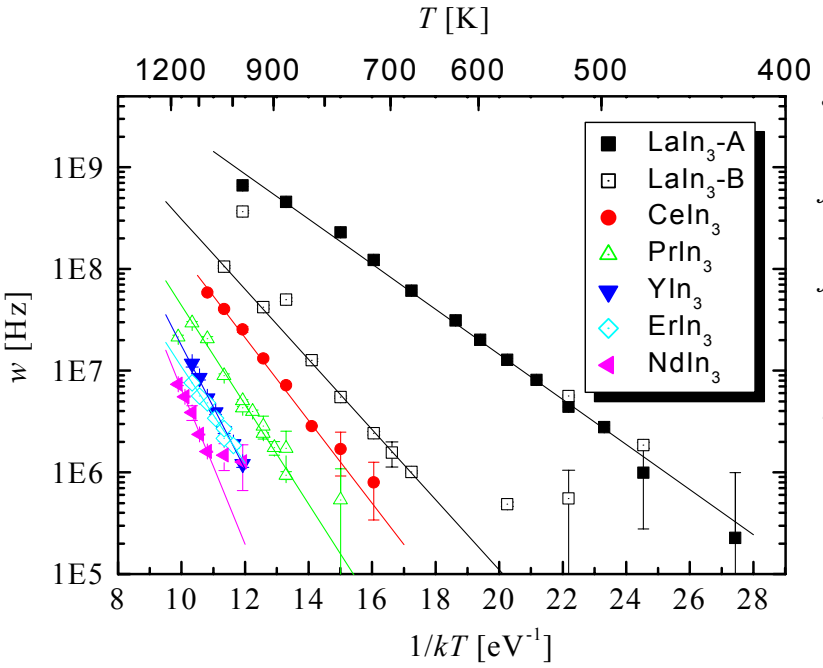
Atom movement in solids

Gary S. Collins, Washington State University, DMR-0091681

Atom movement at high temperature makes solids homogeneous and strong. The traditional way to study atom movement is to measure penetration of tracer atoms into a surface for fixed times at different temperatures. Instead, we are observing the jump frequency *w* of tracer atoms in a new way, through relaxation of precessions of nuclei caused by jumps, as shown at left. At right are shown results for a series of compounds. The measurements give insight into fundamental aspects of atom movement, including how it depends on chemical composition and on atomic defects that are present.



Precessions of nuclei of Cd tracer atoms in In_3La. At higher temperatures, precessions are attenuated by jumps of the tracer atoms. Fits give accurate values of w.



Jump frequency w as a function of temperature for different compounds. Straight-line slopes give energies of activation of motion of the tracer atoms.

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Education:

Participants have been Research Assistant Professor Matthew O. Zacate, graduate student Denys Solodovnikov, and visiting graduate student Aurélie Favrot from the Materials Science Department, Institute Nationale des Sciences Appliques, Rennes, France. Matt Zacate, formerly postdoctoral research associate, was promoted to Research Assistant Professor by the Department of Physics in May 2003. Also associated with the project are Egbert Nieuwenhuis, visiting graduate student from the University of Groningen, The Netherlands, and graduate student Jipeng Wang.

(Work to be submitted for publication in Fall 2003.)

International experience:

Aurélie Favrot, from "slow food" France, meets Ronald McDonald during a three-month stay in the US.